

## THE COLOR OF POLARIZATION IN CUPRATE SUPERCONDUCTORS

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A technique for the identification of individual anisotropic grains in a heterogeneous and opaque material involves the observation of grain color in reflected light through crossed polarizers (color of polarization). Such colors are generally characteristic of particular phases. When grains of many members of the class of hole carrier cuprate superconductors are so viewed, using a xenon light source (6000 K color temperature), a characteristic color of polarization is observed. We have studied this color in many of these cuprate superconductors and found a strong correlation between color and the existence of superconductivity. We have also examined one of the members of the electron carrier cuprate superconductors ( $\text{Nd}_{1.85}\text{Ce}_{.15}\text{CuO}_{4-x}$ ) and found that it possesses the same color of polarization as all the electron hole carrier cuprate superconductors so far examined. The commonality of the characteristic color in the cuprate superconductors indicates that the presence of this color is independent of the nature of charge carriers. The correlation of this color with the existence of superconductivity suggests that the origin of the color relates to the origin of superconductivity in the cuprate superconductors.

Using photometric techniques, we have quantified the color in the  $\text{RBa}_2\text{Cu}_3\text{O}_{7-x}$ -type superconductors by measuring reflectivity. The reflectivity measurements have been made with a xenon light source (6000 K color temperature), as used in viewing the color of polarization. The reflectivity data have been taken on a series of  $\text{ErBa}_2\text{Cu}_3\text{O}_{7-x}$  samples, where  $.1 \leq x \leq .7$ , so as to include both tetragonal insulators and orthorhombic superconductors. These measurements have been iteratively fitted with smooth curves to represent the spectra throughout the visible. From these curves, we have calculated the chromaticity coordinates which can be located on a chromaticity diagram, where the color fields are denoted. The colors found compared well with those observed visually. Possible interpretations of the iterative fits to the reflectivity data by comparison with ellipsometry results available on this type of superconductor, including transmissivity, and noting the absorption characteristics of  $\text{Cu}^{+2}$  will be discussed.